

<110> Walker, David H.
McBride, Jere W.
Yu, Xue-Jie

<120> Homologous 28-Kilodalton Immunodominant Protein
Genes of *Ehrlichia canis* and Uses Thereof

<130> D6152CIP2/D1

<141> 2002-01-31

<150> 09/660,587
<151> 2000-09-12

<160> 46

<210> 1
<211> 1607
<212> DNA
<213> *Ehrlichia canis*

<220>
<223> nucleic acid sequence of *E. canis* p28-7

<400> 1

```

atatttattta ttaccaatct tatataatat attaaatttc tcttacaaaa 50
atctctaattg ttttataacct aatatatata ttctggcttg tatctacttt 100
gcacttccac tattgttaat ttattttcac tatttttaggt gtaatatgaa 150
ttgcaaaaaa attcttataa caactgcatt aatatcatta atgtactcta 200
ttccaagcat atctttttct gatactatac aagatggtaa catgggtggt 250
aacttctata ttagtggaag gtatgtacca agtgtctcac attttggtag 300
cttctcagct aaagaagaaa gcaaatcaac tgttggagtt tttggattaa 350
aacatgattg ggatggaagt ccaatactta agaataaaca cgctgacttt 400
actgttccaa actattcggt cagatacgag aacaatccat ttctaggggt 450
tgcaggagct atcggttact caatgggtgg cccaagaata gaattcgaaa 500
tatcttatga agcattcgac gtaaaaagtc ctaatatcaa ttatcaaaat 550
gacgcgcaca ggtactgcgc tctatctcat cacacatcgg cagccatgga 600
agctgataaa tttgtcttct taaaaaacga agggttaatt gacatatcac 650

```

```

ttgcaataaa tgcattgttat gatataataa atgacaaagt acctgtttct 700
ccttatatat gcgcaggtat tggtagtgat ttgattttcta tgtttgaagc 750
tacaagtcct aaaatttcct accaaggaaa actgggcatt agttactcta 800
ttaatccgga aacctctgtt ttcattcggtg ggcattttcca caggatcata 850
ggtaatgagt ttagagatat tcctgcaata gtacctagta actcaactac 900
aataagtggg ccacaatttg caacagtaac actaaatgtg tgtcactttg 950
gtttagaact tggaggaaga tttaacttct aattttattg ttgccacata 1000
ttaaaaatga tctaaacttg tttttawtat tgctacatac aaaaaaagaa 1050
aaatagtggc aaaagaatgt agcaataaga gggggggggg ggaccaaatt 1100
tatcttctat gcttcccaag ttttttcygc ctatttatga cttaaacaac 1150
agaaggtaat atcctcacgg aaaacttatc ttcaaattt ttatttatta 1200
ccaatcttat ataatatatt aaatttctct taaaaaatc actagtattt 1250
tatacaaaaa tatatatctt gacttgcttt tcttctgcac ttctactatt 1300
tttaatttat ttgtcactat taggttataa taawatgaat tgcmagagat 1350
ttttcatagc aagtgcattg atatcactaa tgtctttctt acctagcgta 1400
tctttttctg aatcaataca tgaagataat ataatggta acttttacat 1450
tagtgcaaag tatatgccaa gtgcctcaca ctttggcgta ttttcagtta 1500
aagaagagaa aaacacaaca actggagttt tcggattaaa acaagattgg 1550
gacggagcaa cactaaagga tgcaagcwgc agccacacaw tagaccaag 1600
tacaatg                                     1607

```

<210> 2

<211> 278

<212> PRT

<213> *Ehrlichia canis*

<220>

<223> amino acid sequence of *E. canis* p28-7 protein

<400> 2

```

Met Asn Cys Lys Lys Ile Leu Ile Thr Thr Ala Leu Ile Ser Leu
      5                      10                      15
Met Tyr Ser Ile Pro Ser Ile Ser Phe Ser Asp Thr Ile Gln Asp
      20                      25                      30

```

[illegible]

<210> 3
 <211> 849
 <212> DNA
 <213> *Ehrlichia canis*

 <220>
 <221> mat_peptide
 <223> nucleic acid sequence of p28-5

<400> 3
 atgaattgta aaaaagtttt cacaataagt gcattgatat catccatata 50
 cttcctacct aatgtctcat actctaacc agtatatggg aacagtatgt 100
 atggtaattt ttacatatca ggaaagtaca tgccaagtgt tcctcatttt 150
 ggaatttttt cagctgaaga agagaaaaaa aagacaactg tagtatatgg 200
 cttaaaagaa aactgggcag gagatgcaat atctagtcaa agtccagatg 250
 ataattttac cattcgaaat tactcattca agtatgcaag caacaagttt 300
 ttaggggttg cagtagctat tggttactcg ataggcagtc caagaataga 350
 agttgagatg tcttatgaag catttgatgt gaaaaatcca ggtgataatt 400
 acaaaaacgg tgcttacagg tattgtgctt tatctcatca agatgatgcg 450
 gatgatgaca tgactagtgc aactgacaaa tttgtatatt taattaatga 500
 aggattactt aacatatcat ttatgacaaa catatgttat gaaacagcaa 550
 gcaaaaatat acctctctct ccttacatat gtgcaggtat tgggtactgat 600
 ttaattcaca tgtttgaaac tacacatcct aaaatttctt atcaaggaaa 650
 gctagggttg gcctacttcg taagtgcaga gtcttcgggt tcttttggtg 700
 tatattttca taaaattata aataataagt ttaaaaatgt tccagccatg 750
 gtacctatta actcagacga gatagtagga ccacagtttg caacagtaac 800
 attaaatgta tgctactttg gattagaact tggatgtagg ttcaacttc 849

<210> 4
 <211> 283
 <212> PRT
 <213> *Ehrlichia canis*

 <220>
 <223> amino acid sequence of p28-5 protein

<400> 4

Met	Asn	Cys	Lys	Lys	Val	Phe	Thr	Ile	Ser	Ala	Leu	Ile	Ser	Ser	5	10	15
Ile	Tyr	Phe	Leu	Pro	Asn	Val	Ser	Tyr	Ser	Asn	Pro	Val	Tyr	Gly	20	25	30
Asn	Ser	Met	Tyr	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro	35	40	45
Ser	Val	Pro	His	Phe	Gly	Ile	Phe	Ser	Ala	Glu	Glu	Glu	Lys	Lys	50	55	60
Lys	Thr	Thr	Val	Val	Tyr	Gly	Leu	Lys	Glu	Asn	Trp	Ala	Gly	Asp	65	70	75
Ala	Ile	Ser	Ser	Gln	Ser	Pro	Asp	Asp	Asn	Phe	Thr	Ile	Arg	Asn	80	85	90
Tyr	Ser	Phe	Lys	Tyr	Ala	Ser	Asn	Lys	Phe	Leu	Gly	Phe	Ala	Val	95	100	105
Ala	Ile	Gly	Tyr	Ser	Ile	Gly	Ser	Pro	Arg	Ile	Glu	Val	Glu	Met	110	115	120
Ser	Tyr	Glu	Ala	Phe	Asp	Val	Lys	Asn	Pro	Gly	Asp	Asn	Tyr	Lys	125	130	135
Asn	Gly	Ala	Tyr	Arg	Tyr	Cys	Ala	Leu	Ser	His	Gln	Asp	Asp	Ala	140	145	150
Asp	Asp	Asp	Met	Thr	Ser	Ala	Thr	Asp	Lys	Phe	Val	Tyr	Leu	Ile	155	160	165
Asn	Glu	Gly	Leu	Leu	Asn	Ile	Ser	Phe	Met	Thr	Asn	Ile	Cys	Tyr	170	175	180
Glu	Thr	Ala	Ser	Lys	Asn	Ile	Pro	Leu	Ser	Pro	Tyr	Ile	Cys	Ala	185	190	195
Gly	Ile	Gly	Thr	Asp	Leu	Ile	His	Met	Phe	Glu	Thr	Thr	His	Pro	200	205	210
Lys	Ile	Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ala	Tyr	Phe	Val	Ser	215	220	225
Ala	Glu	Ser	Ser	Val	Ser	Phe	Gly	Ile	Tyr	Phe	His	Lys	Ile	Ile	230	235	240
Asn	Asn	Lys	Phe	Lys	Asn	Val	Pro	Ala	Met	Val	Pro	Ile	Asn	Ser	245	250	255

Asp Glu Ile Val Gly Pro Gln Phe Ala Thr Val Thr Leu Asn Val
 260 265 270

Cys Tyr Phe Gly Leu Glu Leu Gly Cys Arg Phe Asn Phe
 275 280

<210> 5
 <211> 840
 <212> DNA
 <213> *Ehrlichia canis*
 <220>
 <221> mat_peptide
 <223> nucleic acid sequence of p28-6

<400> 5
 atgaattgca aaaaaattct tataacaact gcattaatgt cattaatgta 50
 ctatgctcca agcatatctt tttctgatac tatacaagac gataacactg 100
 gtagcttcta catcagtgga aaatatgtac caagtgtttc acatttttgg 150
 gtttttctcag ctaaagaaga aagaaactca actgttggag ttttttgatt 200
 aaaacatgat tggaatggag gtacaatata taactcttct ccagaaaata 250
 tattcacagt tcaaaattat tcgttttaa acgaaaacaa cccattctta 300
 gggtttgcag gagctattgg ttattcaatg ggtggcccaa gaatagaact 350
 tgaagtcttg tacgagacat tcgatgtgaa aaatcagaac aataattata 400
 agaacggcgc acacagatac tgtgctttat ctcatcatag ttcagcaaca 450
 agcatgtcct ccgcaagtaa caaatgtgtt ttcttaaaaa atgaagggtt 500
 aattgactta tcatttatga taaatgcatg ctatgacata ataattgaag 550
 gaatgccttt ttcaccttat atttgtgcag gtgttggtac tgatgttggt 600
 tccatgtttg aagctataaa tcctaaaatt tcttaccaag gaaaactagg 650
 attaggttat agtataagtt cagaagcctc tgtttttatc ggtggacact 700
 ttcacagagt cataggtaat gaatttagag acatccctgc tatggttcct 750
 agtggatcaa atcttccaga aaaccaattt gcaatagtaa cactaaatgt 800
 gtgtcacttt ggcatagaac ttggaggaag atttaacttc 840

<210> 6
 <211> 280
 <212> PRT
 <213> *Ehrlichia canis*

 <220>
 <223> amino acid sequence of p28-6 protein

<400> 6
 Met Asn Cys Lys Lys Ile Leu Ile Thr Thr Ala Leu Met Ser Leu
 5 10 15
 Met Tyr Tyr Ala Pro Ser Ile Ser Phe Ser Asp Thr Ile Gln Asp
 20 25 30
 Asp Asn Thr Gly Ser Phe Tyr Ile Ser Gly Lys Tyr Val Pro Ser
 35 40 45
 Val Ser His Phe Gly Val Phe Ser Ala Lys Glu Glu Arg Asn Ser
 50 55 60
 Thr Val Gly Val Phe Gly Leu Lys His Asp Trp Asn Gly Gly Thr
 65 70 75
 Ile Ser Asn Ser Ser Pro Glu Asn Ile Phe Thr Val Gln Asn Tyr
 80 85 90
 Ser Phe Lys Tyr Glu Asn Asn Pro Phe Leu Gly Phe Ala Gly Ala
 95 100 105
 Ile Gly Tyr Ser Met Gly Gly Pro Arg Ile Glu Leu Glu Val Leu
 110 115 120
 Tyr Glu Thr Phe Asp Val Lys Asn Gln Asn Asn Asn Tyr Lys Asn
 125 130 135
 Gly Ala His Arg Tyr Cys Ala Leu Ser His His Ser Ser Ala Thr
 140 145 150
 Ser Met Ser Ser Ala Ser Asn Lys Phe Val Phe Leu Lys Asn Glu
 155 160 165
 Gly Leu Ile Asp Leu Ser Phe Met Ile Asn Ala Cys Tyr Asp Ile
 170 175 180
 Ile Ile Glu Gly Met Pro Phe Ser Pro Tyr Ile Cys Ala Gly Val
 185 190 195

Gly	Thr	Asp	Val	Val	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro	Lys	Ile
				200					205					210
Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Gly	Tyr	Ser	Ile	Ser	Ser	Glu
				215					220					225
Ala	Ser	Val	Phe	Ile	Gly	Gly	His	Phe	His	Arg	Val	Ile	Gly	Asn
				230					235					240
Glu	Phe	Arg	Asp	Ile	Pro	Ala	Met	Val	Pro	Ser	Gly	Ser	Asn	Leu
				245					250					255
Pro	Glu	Asn	Gln	Phe	Ala	Ile	Val	Thr	Leu	Asn	Val	Cys	His	Phe
				260					265					270
Gly	Ile	Glu	Leu	Gly	Gly	Arg	Phe	Asn	Phe					
				275					280					

<210>	7
<211>	133
<212>	PRT
<213>	<i>Ehrlichia canis</i>
<220>	
<223>	partial amino acid sequence of p28-5 protein
<400>	7

Met	Asn	Cys	Lys	Lys	Val	Phe	Thr	Ile	Ser	Ala	Leu	Ile	Ser	Ser
				5					10					15
Ile	Tyr	Phe	Leu	Pro	Asn	Val	Ser	Tyr	Ser	Asn	Pro	Val	Tyr	Gly
				20					25					30
Asn	Ser	Met	Tyr	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro
				35					40					45
Ser	Val	Pro	His	Phe	Gly	Ile	Phe	Ser	Ala	Glu	Glu	Glu	Lys	Lys
				50					55					60
Lys	Thr	Thr	Val	Val	Tyr	Gly	Leu	Lys	Glu	Asn	Trp	Ala	Gly	Asp
				65					70					75
Ala	Ile	Ser	Ser	Gln	Ser	Pro	Asp	Asp	Asn	Phe	Thr	Ile	Arg	Asn
				80					85					90

Tyr	Ser	Phe	Lys	Tyr	Ala	Ser	Asn	Lys	Phe	Leu	Gly	Phe	Ala	Val
				95					100					105
Ala	Ile	Gly	Tyr	Ser	Ile	Gly	Ser	Pro	Arg	Ile	Glu	Val	Glu	Met
				110					115					120
Ser	Tyr	Glu	Ala	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn		
				125					130					

<210> 8

<211> 287

<212> PRT

<213> *Ehrlichia canis*

<220>

<223> amino acid sequence of p28-4 protien

<400> 8

Met	Lys	Tyr	Lys	Lys	Thr	Phe	Thr	Val	Thr	Ala	Leu	Val	Leu	Leu
				5					10					15
Thr	Ser	Phe	Thr	His	Phe	Ile	Pro	Phe	Tyr	Ser	Pro	Ala	Arg	Ala
				20					25					30
Ser	Thr	Ile	His	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro	Thr
				35					40					45
Ala	Ser	His	Phe	Gly	Ile	Phe	Ser	Ala	Lys	Glu	Glu	Gln	Ser	Phe
				50					55					60
Thr	Lys	Val	Leu	Val	Gly	Leu	Asp	Gln	Arg	Leu	Ser	His	Asn	Ile
				65					70					75
Ile	Asn	Asn	Asn	Asp	Thr	Ala	Lys	Ser	Leu	Lys	Val	Gln	Asn	Tyr
				80					85					90
Ser	Phe	Lys	Tyr	Lys	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala
				95					100					105
Ile	Gly	Tyr	Ser	Ile	Gly	Asn	Ser	Arg	Ile	Glu	Leu	Glu	Val	Ser
				110					115					120
His	Glu	Ile	Phe	Asp	Thr	Lys	Asn	Pro	Gly	Asn	Asn	Tyr	Leu	Asn
				125					130					135

Asp	Ser	His	Lys	Tyr	Cys	Ala	Leu	Ser	His	Gly	Ser	His	Ile	Cys
				140					145					150
Ser	Asp	Gly	Asn	Ser	Gly	Asp	Trp	Tyr	Thr	Ala	Lys	Thr	Asp	Lys
				155					160					165
Phe	Val	Leu	Leu	Lys	Asn	Glu	Gly	Leu	Leu	Asp	Val	Ser	Phe	Met
				170					175					180
Leu	Asn	Ala	Cys	Tyr	Asp	Ile	Thr	Thr	Glu	Lys	Met	Pro	Phe	Ser
				185					190					195
Pro	Tyr	Ile	Cys	Ala	Gly	Ile	Gly	Thr	Asp	Leu	Ile	Ser	Met	Phe
				200					205					210
Glu	Thr	Thr	Gln	Asn	Lys	Ile	Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu
				215					220					225
Asn	Tyr	Thr	Ile	Asn	Ser	Arg	Val	Ser	Val	Phe	Ala	Gly	Gly	His
				230					235					240
Phe	His	Lys	Val	Ile	Gly	Asn	Glu	Phe	Lys	Gly	Ile	Pro	Thr	Leu
				245					250					255
Leu	Pro	Asp	Gly	Ser	Asn	Ile	Lys	Val	Gln	Gln	Ser	Ala	Thr	Val
				260					265					270
Thr	Leu	Asp	Val	Cys	His	Phe	Gly	Leu	Glu	Ile	Gly	Ser	Arg	Phe
				275					280					285
Phe	Phe													

<210> 9
 <211> 281
 <212> PRT
 <213> *Ehrlichia chaffeensis*

 <220>
 <223> amino acid sequence of *E. chaffeensis* P28

 <400> 9

Met	Asn	Tyr	Lys	Lys	Val	Phe	Ile	Thr	Ser	Ala	Leu	Ile	Ser	Leu
				5					10					15

Ile	Ser	Ser	Leu	Pro	Gly	Val	Ser	Phe	Ser	Asp	Pro	Ala	Gly	Ser
				20					25					30
Gly	Ile	Asn	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro	Ser
				35					40					45
Ala	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Glu	Glu	Arg	Asn	Thr
				50					55					60
Thr	Val	Gly	Val	Phe	Gly	Leu	Lys	Gln	Asn	Trp	Asp	Gly	Ser	Ala
				65					70					75
Ile	Ser	Asn	Ser	Ser	Pro	Asn	Asp	Val	Phe	Thr	Val	Ser	Asn	Tyr
				80					85					90
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala
				95					100					105
Ile	Gly	Tyr	Ser	Met	Asp	Gly	Pro	Arg	Ile	Glu	Leu	Glu	Val	Ser
				110					115					120
Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys	Asn
				125					130					135
Glu	Ala	His	Arg	Tyr	Cys	Ala	Leu	Ser	His	Asn	Ser	Ala	Ala	Asp
				140					145					150
Met	Ser	Ser	Ala	Ser	Asn	Asn	Phe	Val	Phe	Leu	Lys	Asn	Glu	Gly
				155					160					165
Leu	Leu	Asp	Ile	Ser	Phe	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val	Val
				170					175					180
Gly	Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Ile	Gly
				185					190					195
Thr	Asp	Leu	Val	Ser	Met	Phe	Glu	Ala	Thr	Asn	Pro	Lys	Ile	Ser
				200					205					210
Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Ser	Pro	Glu	Ala
				215					220					225
Ser	Val	Phe	Ile	Gly	Gly	His	Phe	His	Lys	Val	Ile	Gly	Asn	Glu
				230					235					240
Phe	Arg	Asp	Ile	Pro	Thr	Ile	Ile	Pro	Thr	Gly	Ser	Thr	Leu	Ala
				245					250					255
Gly	Lys	Gly	Asn	Tyr	Pro	Ala	Ile	Val	Ile	Leu	Asp	Val	Cys	His
				260					265					270

Phe Gly Ile Glu Leu Gly Gly Arg Phe Ala Phe
 275 280

<210> 10
 <211> 283
 <212> PRT
 <213> *Ehrlichia chaffeensis*

<220>
 <223> amino acid sequence of *E. chaffeensis* OMP-1B

<400> 10
 Met Asn Tyr Lys Lys Ile Phe Val Ser Ser Ala Leu Ile Ser Leu
 5 10 15
 Met Ser Ile Leu Pro Tyr Gln Ser Phe Ala Asp Pro Val Thr Ser
 20 25 30
 Asn Asp Thr Gly Ile Asn Asp Ser Arg Glu Gly Phe Tyr Ile Ser
 35 40 45
 Val Lys Tyr Asn Pro Ser Ile Ser His Phe Arg Lys Phe Ser Ala
 50 55 60
 Glu Glu Ala Pro Ile Asn Gly Asn Thr Ser Ile Thr Lys Lys Val
 65 70 75
 Phe Gly Leu Lys Lys Asp Gly Asp Ile Ala Gln Ser Ala Asn Phe
 80 85 90
 Asn Arg Thr Asp Pro Ala Leu Glu Phe Gln Asn Asn Leu Ile Ser
 95 100 105
 Gly Phe Ser Gly Ser Ile Gly Tyr Ala Met Asp Gly Pro Arg Ile
 110 115 120
 Glu Leu Glu Ala Ala Tyr Gln Lys Phe Asp Ala Lys Asn Pro Asp
 125 130 135
 Asn Asn Asp Thr Asn Ser Gly Asp Tyr Tyr Lys Tyr Phe Gly Leu
 140 145 150
 Ser Arg Glu Asp Ala Ile Ala Asp Lys Lys Tyr Val Val Leu Lys
 155 160 165

Pro	Thr	Val	Ala	Leu	Tyr	Gly	Leu	Lys	Gln	Asp	Trp	Asn	Gly	Val
				65					70					75
Ser	Ala	Ser	Ser	His	Ala	Asp	Ala	Asp	Phe	Asn	Asn	Lys	Gly	Tyr
				80					85					90
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala
				95					100					105
Ile	Gly	Tyr	Ser	Met	Gly	Gly	Pro	Arg	Ile	Glu	Phe	Glu	Val	Ser
				110					115					120
Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Gly	Asn	Tyr	Lys	Asn
				125					130					135
Asp	Ala	His	Arg	Tyr	Cys	Ala	Leu	Asp	Arg	Lys	Ala	Ser	Ser	Thr
				140					145					150
Asn	Ala	Thr	Ala	Ser	His	Tyr	Val	Leu	Leu	Lys	Asn	Glu	Gly	Leu
				155					160					165
Leu	Asp	Ile	Ser	Leu	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val	Val	Ser
				170					175					180
Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Val	Gly	Thr
				185					190					195
Asp	Leu	Ile	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro	Lys	Ile	Ser	Tyr
				200					205					210
Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Asn	Pro	Glu	Ala	Ser
				215					220					225
Val	Phe	Val	Gly	Gly	His	Phe	His	Lys	Val	Ala	Gly	Asn	Glu	Phe
				230					235					240
Arg	Asp	Ile	Ser	Thr	Leu	Lys	Ala	Phe	Ala	Thr	Pro	Ser	Ser	Ala
				245					250					255
Ala	Thr	Pro	Asp	Leu	Ala	Thr	Val	Thr	Leu	Ser	Val	Cys	His	Phe
				260					265					270
Gly	Val	Glu	Leu	Gly	Gly	Arg	Phe	Asn	Phe					
				275					280					

<210>	12
<211>	286
<212>	PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> amino acid sequence of *E. chaffeensis* OMP-1D

<400> 12

Met	Asn	Cys	Glu	Lys	Phe	Phe	Ile	Thr	Thr	Ala	Leu	Thr	Leu	Leu
				5					10					15
Met	Ser	Phe	Leu	Pro	Gly	Ile	Ser	Leu	Ser	Asp	Pro	Val	Gln	Asp
				20					25					30
Asp	Asn	Ile	Ser	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Met	Pro
				35					40					45
Ser	Ala	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Glu	Glu	Arg	Asn
				50					55					60
Thr	Thr	Val	Gly	Val	Phe	Gly	Ile	Glu	Gln	Asp	Trp	Asp	Arg	Cys
				65					70					75
Val	Ile	Ser	Arg	Thr	Thr	Leu	Ser	Asp	Ile	Phe	Thr	Val	Pro	Asn
				80					85					90
Tyr	Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Leu	Phe	Ser	Gly	Phe	Ala	Gly
				95					100					105
Ala	Ile	Gly	Tyr	Ser	Met	Asp	Gly	Pro	Arg	Ile	Glu	Leu	Glu	Val
				110					115					120
Ser	Tyr	Glu	Ala	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys
				125					130					135
Asn	Glu	Ala	His	Arg	Tyr	Tyr	Ala	Leu	Ser	His	Leu	Leu	Gly	Thr
				140					145					150
Glu	Thr	Gln	Ile	Asp	Gly	Ala	Gly	Ser	Ala	Ser	Val	Phe	Leu	Ile
				155					160					165
Asn	Glu	Gly	Leu	Leu	Asp	Lys	Ser	Phe	Met	Leu	Asn	Ala	Cys	Tyr
				170					175					180
Asp	Val	Ile	Ser	Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala
				185					190					195
Gly	Ile	Gly	Ile	Asp	Leu	Val	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro
				200					205					210

Lys	Ile	Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Pro	Ile	Ser
				215					220					225
Pro	Glu	Ala	Ser	Val	Phe	Ile	Gly	Gly	His	Phe	His	Lys	Val	Ile
				230					235					240
Gly	Asn	Glu	Phe	Arg	Asp	Ile	Pro	Thr	Met	Ile	Pro	Ser	Glu	Ser
				245					250					255
Ala	Leu	Ala	Gly	Lys	Gly	Asn	Tyr	Pro	Ala	Ile	Val	Thr	Leu	Asp
				260					265					270
Val	Phe	Tyr	Phe	Gly	Ile	Glu	Leu	Gly	Gly	Arg	Phe	Asn	Phe	Gln
				275					280					285

Leu

<210> 13

<211> 278

<212> PRT

<213> *Ehrlichia chaffeensis*

<220>

<223> amino acid sequence of *E. chaffeensis* OMP-1E

<400> 13

Met	Asn	Cys	Lys	Lys	Phe	Phe	Ile	Thr	Thr	Ala	Leu	Val	Ser	Leu
				5					10					15
Met	Ser	Phe	Leu	Pro	Gly	Ile	Ser	Phe	Ser	Asp	Pro	Val	Gln	Gly
				20					25					30
Asp	Asn	Ile	Ser	Gly	Asn	Phe	Tyr	Val	Ser	Gly	Lys	Tyr	Met	Pro
				35					40					45
Ser	Ala	Ser	His	Phe	Gly	Met	Phe	Ser	Ala	Lys	Glu	Glu	Lys	Asn
				50					55					60
Pro	Thr	Val	Ala	Leu	Tyr	Gly	Leu	Lys	Gln	Asp	Trp	Glu	Gly	Ile
				65					70					75
Ser	Ser	Ser	Ser	His	Asn	Asp	Asn	His	Phe	Asn	Asn	Lys	Gly	Tyr
				80					85					90
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Ala
				95					100					105

Ile Gly Tyr Ser Met Gly Gly Pro Arg Val Glu Phe Glu Val Ser
 110 115 120
 Tyr Glu Thr Phe Asp Val Lys Asn Gln Gly Asn Asn Tyr Lys Asn
 125 130 135
 Asp Ala His Arg Tyr Cys Ala Leu Gly Gln Gln Asp Asn Ser Gly
 140 145 150
 Ile Pro Lys Thr Ser Lys Tyr Val Leu Leu Lys Ser Glu Gly Leu
 155 160 165
 Leu Asp Ile Ser Phe Met Leu Asn Ala Cys Tyr Asp Ile Ile Asn
 170 175 180
 Glu Ser Ile Pro Leu Ser Pro Tyr Ile Cys Ala Gly Val Gly Thr
 185 190 195
 Asp Leu Ile Ser Met Phe Glu Ala Thr Asn Pro Lys Ile Ser Tyr
 200 205 210
 Gln Gly Lys Leu Gly Leu Ser Tyr Ser Ile Asn Pro Glu Ala Ser
 215 220 225
 Val Phe Ile Gly Gly His Phe His Lys Val Ile Gly Asn Glu Phe
 230 235 240
 Arg Asp Ile Pro Thr Leu Lys Ala Phe Val Thr Ser Ser Ala Thr
 245 250 255
 Pro Asp Leu Ala Ile Val Thr Leu Ser Val Cys His Phe Gly Ile
 260 265 270
 Glu Leu Gly Gly Arg Phe Asn Phe
 275

<210> 14
 <211> 280
 <212> PRT
 <213> *Ehrlichia chaffeensis*
 <220>
 <223> amino acid sequence of *E. chaffeensis* OMP-1F

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100

<400>														14
Met	Asn	Cys	Lys	Lys	Phe	Phe	Ile	Thr	Thr	Thr	Leu	Val	Ser	Leu
				5					10					15
Met	Ser	Phe	Leu	Pro	Gly	Ile	Ser	Phe	Ser	Asp	Ala	Val	Gln	Asn
				20					25					30
Asp	Asn	Val	Gly	Gly	Asn	Phe	Tyr	Ile	Ser	Gly	Lys	Tyr	Val	Pro
				35					40					45
Ser	Val	Ser	His	Phe	Gly	Val	Phe	Ser	Ala	Lys	Gln	Glu	Arg	Asn
				50					55					60
Thr	Thr	Thr	Gly	Val	Phe	Gly	Leu	Lys	Gln	Asp	Trp	Asp	Gly	Ser
				65					70					75
Thr	Ile	Ser	Lys	Asn	Ser	Pro	Glu	Asn	Thr	Phe	Asn	Val	Pro	Asn
				80					85					90
Tyr	Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly
				95					100					105
Ala	Val	Gly	Tyr	Leu	Met	Asn	Gly	Pro	Arg	Ile	Glu	Leu	Glu	Met
				110					115					120
Ser	Tyr	Glu	Thr	Phe	Asp	Val	Lys	Asn	Gln	Gly	Asn	Asn	Tyr	Lys
				125					130					135
Asn	Asp	Ala	His	Lys	Tyr	Tyr	Ala	Leu	Thr	His	Asn	Ser	Gly	Gly
				140					145					150
Lys	Leu	Ser	Asn	Ala	Gly	Asp	Lys	Phe	Val	Phe	Leu	Lys	Asn	Glu
				155					160					165
Gly	Leu	Leu	Asp	Ile	Ser	Leu	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Val
				170					175					180
Ile	Ser	Glu	Gly	Ile	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Val
				185					190					195
Gly	Thr	Asp	Leu	Ile	Ser	Met	Phe	Glu	Ala	Ile	Asn	Pro	Lys	Ile
				200					205					210
Ser	Tyr	Gln	Gly	Lys	Leu	Gly	Leu	Ser	Tyr	Ser	Ile	Ser	Pro	Glu
				215					220					225
Ala	Ser	Val	Phe	Val	Gly	Gly	His	Phe	His	Lys	Val	Ile	Gly	Asn
				230					235					240
Glu	Phe	Arg	Asp	Ile	Pro	Ala	Met	Ile	Pro	Ser	Thr	Ser	Thr	Leu
				245					250					255

Thr	Gly	Asn	His	Phe	Thr	Ile	Val	Thr	Leu	Ser	Val	Cys	His	Phe
				260					265					270

Gly	Val	Glu	Leu	Gly	Gly	Arg	Phe	Asn	Phe
				275					280

<210> 15
 <211> 284
 <212> PRT
 <213> *Cowdria ruminantium*

<220>
 <223> amino acid sequence of *C. ruminantium* MAP-1

<400>	15
Met Asn Cys Lys Lys Ile Phe Ile Thr Ser Thr Leu Ile Ser Leu	
	5 10 15
Val Ser Phe Leu Pro Gly Val Ser Phe Ser Asp Val Ile Gln Glu	
	20 25 30
Glu Asn Asn Pro Val Gly Ser Val Tyr Ile Ser Ala Lys Tyr Met	
	35 40 45
Pro Thr Ala Ser His Phe Gly Lys Met Ser Ile Lys Glu Asp Ser	
	50 55 60
Arg Asp Thr Lys Ala Val Phe Gly Leu Lys Lys Asp Trp Asp Gly	
	65 70 75
Val Lys Thr Pro Ser Gly Asn Thr Asn Ser Ile Phe Thr Glu Lys	
	80 85 90
Asp Tyr Ser Phe Lys Tyr Glu Asn Asn Pro Phe Leu Gly Phe Ala	
	95 100 105
Gly Ala Val Gly Tyr Ser Met Asn Gly Pro Arg Ile Glu Phe Glu	
	110 115 120
Val Ser Tyr Glu Thr Phe Asp Val Arg Asn Pro Gly Gly Asn Tyr	
	125 130 135
Lys Asn Asp Ala His Met Tyr Cys Ala Leu Asp Thr Ala Ser Ser	
	140 145 150

Ser	Thr	Ala	Gly	Ala	Thr	Thr	Ser	Val	Met	Val	Lys	Asn	Glu	Asn
				155					160					165
Leu	Thr	Asp	Ile	Ser	Leu	Met	Leu	Asn	Ala	Cys	Tyr	Asp	Ile	Met
				170					175					180
Leu	Asp	Gly	Met	Pro	Val	Ser	Pro	Tyr	Val	Cys	Ala	Gly	Ile	Gly
				185					190					195
Thr	Asp	Leu	Val	Ser	Val	Ile	Asn	Ala	Thr	Asn	Pro	Lys	Leu	Ser
				200					205					210
Tyr	Gln	Gly	Lys	Leu	Gly	Ile	Ser	Tyr	Ser	Ile	Asn	Pro	Glu	Ala
				215					220					225
Ser	Ile	Phe	Ile	Gly	Gly	His	Phe	His	Arg	Val	Ile	Gly	Asn	Glu
				230					235					240
Phe	Lys	Asp	Ile	Ala	Thr	Ser	Lys	Val	Phe	Thr	Ser	Ser	Gly	Asn
				245					250					255
Ala	Ser	Ser	Ala	Val	Ser	Pro	Gly	Phe	Ala	Ser	Ala	Ile	Leu	Asp
				260					265					270
Val	Cys	His	Phe	Gly	Ile	Glu	Ile	Gly	Gly	Arg	Phe	Val	Phe	
				275					280					

<210> 16
 <211> 20
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind
 <222> nucleotides 313-332 of *C. ruminantium* MAP-1,
 also nucleotides 307-326 of *E. chaffeensis* P28
 <223> forward primer 793 for PCR

<400> 16
 gcaggagctg ttggttactc 20

<210> 17
 <211> 21
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind
 <222> nucleotides 823-843 of *C. ruminantium* MAP-1,
 also nucleotides 814-834 of *E. chaffeensis* P28
 <223> reverse primer 1330 for PCR

<400> 17
 ccttcctcca agttctatgc c 21

<210> 18
 <211> 24
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind
 <223> primer 46f, specific for p28-5 gene

<400> 18
 atatacttcc tacctaattgt ctca 24

<210> 19
 <211> 20
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind

<223> primer used for sequencing 28-kDa protein
genes in *E. canis*

<400> 19
agtgcagagt cttcggtttc 20

<210> 20
<211> 18
<212> DNA
<213> artificial sequence

<220>
<221> primer_bind
<223> primer used for sequencing 28-kDa protein
genes in *E. canis*

<400> 20
gttacttgcg gaggacat 18

<210> 21
<211> 24
<212> DNA
<213> artificial sequence

<220>
<221> primer_bind
<222> nucleotides 687-710 of *E. canis* p28-7
<223> primer 394 for PCR

<400> 21
gcatttccac aggatcatag gtaa 24

<210> 22
 <211> 24
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind
 <222> nucleotides 710-687 of *E. canis* p28-7
 <223> primer 394C for PCR

<400> 22
 ttacctatga tcctgtggaa atgc 24

<210> 23
 <211> 20
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind
 <223> primer 793C which anneals to a region with *E. canis*
 p28-7, used to amplify the intergenic region
 between gene p28-6 and p28-7

<400> 23
 gagtaaccaa cagctcctgc 20

<210> 24
 <211> 24
 <212> DNA
 <213> artificial sequence

 <220>
 <221> primer_bind

<222>

<223> primer EC280M-F complementary to noncoding regions
adjacent to the open reading frame of *p28-7*

<400> 24

tctacttttgc acttccacta ttgt 24

<210> 25

<211> 24

<212> DNA

<213> artificial sequence

<220>

<221> primer_bind

<222>

<223> primer EC280M-R complementary to noncoding regions
adjacent to the open reading frame of *p28-7*

<400> 25

attctttttgc cactattttt cttt 24

<210> 26

<211> 25

<212> DNA

<213> artificial sequence

<220>

<221> primer_bind

<223> primer *ECaSA3-2* corresponding to regions within
p28-6, used to amplify the intergenic region NC3
between gene *p28-6* and *p28-7*

<400> 26

ctaggattag gttatagtat aagtt 25

<210> 27
 <211> 23
 <212> PRT
 <213> *Ehrlichia canis*

<220>
 <221> PEPTIDE
 <223> a predicted N-terminal signal peptide of p28-7
 and p28-6

<400> 27

Met Asn Cys Lys Lys Ile Leu Ile Thr Thr Ala Leu Met Ser Leu

5 10 15

Met Tyr Tyr Ala Pro Ser Ile Ser

20

<210> 28
 <211> 25
 <212> PRT
 <213> *Ehrlichia chaffeensis*

<220>
 <223> amino acid sequence of N-terminal signal peptide of
E. chaffeensis P28

<400> 28

Met Asn Tyr Lys Lys Ile Leu Ile Thr Ser Ala Leu Ile Ser Leu

5 10 15

Ile Ser Ser Leu Pro Gly Val Ser Phe Ser

20 25

<210> 29
 <211> 26

<212> PRT
 <213> *Ehrlichia canis*
 <220>
 <223> amino acid sequence of putative cleavage site of
 p28-7

<400> 29
 Met Asn Cys Lys Lys Ile Leu Ile Thr Thr Ala Leu Ile Ser Leu
 5 10 15
 Met Tyr Ser Ile Pro Ser Ile Ser Ser Phe Ser
 20 25

<210> 30
 <211> 299
 <212> DNA
 <213> *Ehrlichia canis*
 <220>
 <223> nucleic acid sequence of intergenic
 noncoding region 1 (28NC1)

<400> 30
 taatacttct attgtacatg ttaaaaatag tactagtttg cttctgtggt 50
 ttataaacgc aagagagaaa tagttagtaa taaattagaa agttaaatat 100
 tagaaaagtc atatgttttt cattgtcatt gatactcaac taaaagtagt 150
 ataaatgtta cttattaata attttacgta gtatattaaa tttcccttac 200
 aaaagccact agtattttat actaaaagct atactttggc ttgtatttaa 250
 tttgtatttt tactactgtt aatttacttt cactgtttct ggtgtaaat 299

<210> 31
 <211> 345
 <212> DNA
 <213> *Ehrlichia canis*

<220>

<223> nucleic acid sequence of intergenic noncoding
region 2 (28NC2)

<400> 31

taatttcgtg gtacacatat cacgaagcta aaattgtttt tttatctctg 50
ctgtatacaa gagaaaaaat agtagtgaaa attacctaac aatatgacag 100
tacaagttta ccaagcttat tctcacaaaa cttcttgtgt cttttatctc 150
tttacaatga aatgtacact tagcttcact actgtagagt gtgtttatca 200
atgctttgtt tattaatact ctacataata tgttaaattt ttcttataaaa 250
actcactagt aattttatact agaatatata ttctgacttg tatttgcttt 300
atacttccac tattgttaat ttattttcac tatttttaggt gtaat 345

<210> 32

<211> 345

<212> DNA

<213> *Ehrlichia canis*

<220>

<223> nucleic acid sequence of intergenic
noncoding region 3 (28NC3)

<400> 32

tgatttttatt gttgccacat attaaaaatg atctaaactt gtttttatta 50
ttgctacata caaaaaaaag aaaaatagtg gcaaaagaat gtagcaataa 100
gagggggggg ggggactaaa tttaccttct attcttctaa tattctttac 150
tatattcaaa tagcacaact caatgcttcc aggaaaatat gtttctaata 200
ttttatttat taccaatcct tatataatat attaaatttc tcttacaaaa 250
atctctaatag ttttatactt aatatatata ttctggcttg tatttacttt 300
gcacttccac tattgttaat ttattttcac tatttttaggt gtaat 345

<210> 33

<211> 355

<212> DNA

<213> *Ehrlichia canis*
 <220>
 <223> nucleic acid sequence of intergenic
 noncoding region 4 (28NC4)

<400> 33
 taattttatt gttgccacat attaaaaatg atctaaactt gtttttawta 50
 ttgctacata caaaaaaaga aaaatagtgg caaaagaatg tagcaataag 100
 agggggggggg gggaccaaatt ttatcttcta tgcttcccaa gttttttcyc 150
 gctatttatg acttaaacia cagaaggtaa tatkctcacg gaaaacttat 200
 cttcaaatat ttattttatt accaatctta tataatatat taaattttctc 250
 ttacaaaaat cactagtatt ttataccaaa atatatttc tgacttgctt 300
 ttcttctgca cttctactat ttttaattta tttgtcacta ttaggttata 350
 ataaw 355

<210> 34
 <211> 24
 <212> DNA
 <213> artificial sequence
 <220>
 <223> primer p28-5-818f

<400> 34
 ttaaacaatat gccacttcgg acta 24

<210> 35
 <211> 28
 <212> DNA
 <213> artificial sequence
 <220>
 <223> primer 1191

<400> 35
tatgatcgtg taaaattgct gtgagtat 28

<210> 36
<211> 20
<212> DNA
<213> artificial sequence

<220>
<223> primer ECa28-75C

<400> 36
tactggcacg tgctggacta 20

<210> 37
<211> 22
<212> DNA
<213> artificial sequence

<220>
<223> primer ECa5'-1600

<400> 37
caccaataaa tgcagagact tc 22

<210> 38
<211> 26
<212> DNA
<213> artificial sequence

<220>
<223> primer 3125

<400> 38
aatccatcat ttctcattac agtgtg 26

<210> 39

<211> 879

<212> DNA

<213> *Ehrlichia canis*

<220>

<223> nucleic acid sequence of *E. canis* p28-1

<400> 39

atgaataata aactcaaatt tactataata aacacagtat tagtatgctt 50
attgtcatta cctaatatat cttcctcaaa ggccataaac aataacgcta 100
aaaagtacta cggattatat atcagtggac aatataaacc cagtgtttct 150
gttttcagta atttttcagt taaagaaacc aatgtcataa ctaaaaacct 200
tatagcttta aaaaaagatg ttgactctat tgaaaccaag actgatgcc 250
gtgtaggtat tagtaacca tcaaatttta ctatccccta tacagctgta 300
tttcaagata attctgtcaa tttcaatgga actattgggt acacctttgc 350
tgaaggtaca agagttgaaa tagaagggtc ttatgaggaa tttgatgtta 400
aaaaccctgg aggctataca ctaagtgatg cctatcgcta ttttgcatta 450
gcacgtgaaa tgaaaggtaa tagttttaca cctaaagaaa aagtttctaa 500
tagtatTTTTT cactctgtaa tgagaaatga tggattatct ataatatctg 550
ttatagtaaa tgtttgctac gatttctctt tgaacaattt gtcaatatcg 600
ccttacatat gtggaggagc aggggtagat gctatagaat tcttcgatgt 650
attacacatt aagtttgc atcaaagcaa gctaggtatt gcttattctc 700
taccatctaa cattagtctc tttgctagtt tatattacca taaagtaatg 750
ggcaatcaat ttaaaaattt aaatgtccaa catggttgctg aacttgcaag 800
tatacctaaa attacatccg cagttgctac acttaatat gggtattttg 850
gaggtgaaat tggtgcaaga ttgacattt 879

<210> 40

<211> 293

<212> PRT

<213> *Ehrlichia canis*

<220>

<223> amino acid sequence of *E. canis* p28-1 protein

<400> 40

Met Asn Asn Lys Leu Lys Phe Thr Ile Ile Asn Thr Val Leu Val
5 10 15
Cys Leu Leu Ser Leu Pro Asn Ile Ser Ser Ser Lys Ala Ile Asn
20 25 30
Asn Asn Ala Lys Lys Tyr Tyr Gly Leu Tyr Ile Ser Gly Gln Tyr
35 40 45
Lys Pro Ser Val Ser Val Phe Ser Asn Phe Ser Val Lys Glu Thr
50 55 60
Asn Val Ile Thr Lys Asn Leu Ile Ala Leu Lys Lys Asp Val Asp
65 70 75
Ser Ile Glu Thr Lys Thr Asp Ala Ser Val Gly Ile Ser Asn Pro
80 85 90
Ser Asn Phe Thr Ile Pro Tyr Thr Ala Val Phe Gln Asp Asn Ser
95 100 105
Val Asn Phe Asn Gly Thr Ile Gly Tyr Thr Phe Ala Glu Gly Thr
110 115 120
Arg Val Glu Ile Glu Gly Ser Tyr Glu Glu Phe Asp Val Lys Asn
125 130 135
Pro Gly Gly Tyr Thr Leu Ser Asp Ala Tyr Arg Tyr Phe Ala Leu
140 145 150
Ala Arg Glu Met Lys Gly Asn Ser Phe Thr Pro Lys Glu Lys Val
155 160 165
Ser Asn Ser Ile Phe His Thr Val Met Arg Asn Asp Gly Leu Ser
170 175 180
Ile Ile Ser Val Ile Val Asn Val Cys Tyr Asp Phe Ser Leu Asn
185 190 195
Asn Leu Ser Ile Ser Pro Tyr Ile Cys Gly Gly Ala Gly Val Asp
200 205 210
Ala Ile Glu Phe Phe Asp Val Leu His Ile Lys Phe Ala Tyr Gln
215 220 225
Ser Lys Leu Gly Ile Ala Tyr Ser Leu Pro Ser Asn Ile Ser Leu
230 235 240

SEQUENCE

Phe	Ala	Ser	Leu	Tyr	Tyr	His	Lys	Val	Met	Gly	Asn	Gln	Phe	Lys
				245					250					255
Asn	Leu	Asn	Val	Gln	His	Val	Ala	Glu	Leu	Ala	Ser	Ile	Pro	Lys
				260					265					270
Ile	Thr	Ser	Ala	Val	Ala	Thr	Leu	Asn	Ile	Gly	Tyr	Phe	Gly	Gly
				275					280					285
Glu	Ile	Gly	Ala	Arg	Leu	Thr	Phe							
				290			293							

<210> 41

<211> 840

<212> DNA

<213> *Ehrlichia canis*

<220>

<223> nucleic acid sequence of *E. canis* p28-2

<400> 41

atgaattata	agaaaattct	agtaagaagc	gcgtaaatct	cattaatgtc	50
aatcttacca	tatcagtctt	ttgcagatcc	tgtaggttca	agaactaatg	100
ataacaaaga	aggcttctac	attagtgcaa	agtacaatcc	aagtatatca	150
cactttagaa	aatttctctgc	tgaagaaact	cctattaatg	gaacaaattc	200
tctcactaaa	aaagtttttcg	gactaaagaa	agatggtgat	ataacaaaaa	250
aagacgattt	tacaagagta	gctccaggca	ttgattttca	aaataactta	300
atatcaggat	tttcaggaag	tattgggttac	tctatggacg	gaccaagaat	350
agaacttgaa	gctgcatatc	aacaatttaa	tccaaaaaac	accgataaca	400
atgatactga	taatggtgaa	tactataaac	atthttgcatt	atctcgtaaa	450
gatgcaatgg	aagatcagca	atatgtagta	cttaaaaaatg	acggcataac	500
ttttatgtca	ttgatggtta	atacttgcta	tgacattaca	gctgaaggag	550
tatctttcgt	accatatgca	tgtgcaggta	taggagcaga	tcttatcact	600
atthtttaaag	acctcaatct	aaaatttgct	taccaaggaa	aaataggtat	650
tagttaccct	atcacaccag	aagtctctgc	atttattggt	ggatactacc	700
atggcggttat	tggtataaaa	tttgagaaga	tacctgtaat	aactcctgta	750
gtattaaatg	atgctcctca	aaccacatct	gcttcagtaa	ctcttgacgt	800
tggatacttt	ggcggagaaa	ttggaatgag	gttcaccttc		840

<210> 42
 <211> 280
 <212> PRT
 <213> *Ehrlichia canis*

 <220>
 <223> amino acid sequence of *E. canis* p28-2 protein

<400> 42
 Met Asn Tyr Lys Lys Ile Leu Val Arg Ser Ala Leu Ile Ser Leu
 5 10 15
 Met Ser Ile Leu Pro Tyr Gln Ser Phe Ala Asp Pro Val Gly Ser
 20 25 30
 Arg Thr Asn Asp Asn Lys Glu Gly Phe Tyr Ile Ser Ala Lys Tyr
 35 40 45
 Asn Pro Ser Ile Ser His Phe Arg Lys Phe Ser Ala Glu Glu Thr
 50 55 60
 Pro Ile Asn Gly Thr Asn Ser Leu Thr Lys Lys Val Phe Gly Leu
 65 70 75
 Lys Lys Asp Gly Asp Ile Thr Lys Lys Asp Asp Phe Thr Arg Val
 80 85 90
 Ala Pro Gly Ile Asp Phe Gln Asn Asn Leu Ile Ser Gly Phe Ser
 95 100 105
 Gly Ser Ile Gly Tyr Ser Met Asp Gly Pro Arg Ile Glu Leu Glu
 110 115 120
 Ala Ala Tyr Gln Gln Phe Asn Pro Lys Asn Thr Asp Asn Asn Asp
 125 130 135
 Thr Asp Asn Gly Glu Tyr Tyr Lys His Phe Ala Leu Ser Arg Lys
 140 145 150
 Asp Ala Met Glu Asp Gln Gln Tyr Val Val Leu Lys Asn Asp Gly
 155 160 165
 Ile Thr Phe Met Ser Leu Met Val Asn Thr Cys Tyr Asp Ile Thr
 170 175 180
 Ala Glu Gly Val Ser Phe Val Pro Tyr Ala Cys Ala Gly Ile Gly
 185 190 195

Ala	Asp	Leu	Ile	Thr	Ile	Phe	Lys	Asp	Leu	Asn	Leu	Lys	Phe	Ala
				200					205					210
Tyr	Gln	Gly	Lys	Ile	Gly	Ile	Ser	Tyr	Pro	Ile	Thr	Pro	Glu	Val
				215					220					225
Ser	Ala	Phe	Ile	Gly	Gly	Tyr	Tyr	His	Gly	Val	Ile	Gly	Asn	Lys
				230					235					240
Phe	Glu	Lys	Ile	Pro	Val	Ile	Thr	Pro	Val	Val	Leu	Asn	Asp	Ala
				245					250					255
Pro	Gln	Thr	Thr	Ser	Ala	Ser	Val	Thr	Leu	Asp	Val	Gly	Tyr	Phe
				260					265					270
Gly	Gly	Glu	Ile	Gly	Met	Arg	Phe	Thr	Phe					
				275					280					

<210> 43

<211> 828

<212> DNA

<213> *Ehrlichia canis*

<220>

<223> nucleic acid sequence of *E. canis* p28-3

<400> 43

```

atgaactgta aaaaaattct tataacaact acattggtat cactaacaat 50
tctttttacct ggcataatctt tctccaaacc aatacatgaa aacaatacta 100
caggaaactt ttacattatt ggaaaatatg taccaagtat ttcacatttt 150
gggaactttt cagctaaaga agaaaaaaac acaacaactg gaatttttgg 200
attaaaagaa tcatggactg gtggtatcat ccttgataaa gaacatgcag 250
ctttttaatat cccaaattat tcatttaa atgaaaataa tccatttttta 300
ggatttgcag gggtaattgg ctattcaata ggtagtccaa gaatagaatt 350
tgaagtatca tacgagacat tcgatgtaca aaatccagga gataagttta 400
acaatgatgc acataagtat tgtgctttat ccaatgattc cagtaaaaca 450
atgaaaagtg gtaaattcgt ttttctcaaa aatgaaggat taagtgcacat 500
atcactcatg ttaaattgat gttatgatat aataaacaaa agaatgcctt 550
tttcacctta catatgtgca ggcattggta ctgacttaat attcatgttt 600
gacgctataa accataaagc tgcttatcaa ggaaaattag gttttaatta 650

```

tccaataagc ccagaagcta acattttctat ggggtgtgcac tttcacaaag 700
 taacaaacaa cgagttttaga gttcctgttc tattaactgc tggaggactc 750
 gctccagata atctatttgc aatagtaaag ttgagtatat gtcattttgg 800
 gttagaattt gggtagaggg tcagtttt 828

<210> 44

<211> 276

<212> PRT

<213> *Ehrlichia canis*

<220>

<223> amino acid sequence of *E. canis* p28-3 protein

<400> 44

Met	Asn	Cys	Lys	Lys	Ile	Leu	Ile	Thr	Thr	Thr	Leu	Val	Ser	Leu			
				5					10					15			
Thr	Ile	Leu	Leu	Pro	Gly	Ile	Ser	Phe	Ser	Lys	Pro	Ile	His	Glu			
				20					25					30			
Asn	Asn	Thr	Thr	Gly	Asn	Phe	Tyr	Ile	Ile	Gly	Lys	Tyr	Val	Pro			
				35					40					45			
Ser	Ile	Ser	His	Phe	Gly	Asn	Phe	Ser	Ala	Lys	Glu	Glu	Lys	Asn			
				50					55					60			
Thr	Thr	Thr	Gly	Ile	Phe	Gly	Leu	Lys	Glu	Ser	Trp	Thr	Gly	Gly			
				65					70					75			
Ile	Ile	Leu	Asp	Lys	Glu	His	Ala	Ala	Phe	Asn	Ile	Pro	Asn	Tyr			
				80					85					90			
Ser	Phe	Lys	Tyr	Glu	Asn	Asn	Pro	Phe	Leu	Gly	Phe	Ala	Gly	Val			
				95					100					105			
Ile	Gly	Tyr	Ser	Ile	Gly	Ser	Pro	Arg	Ile	Glu	Phe	Glu	Val	Ser			
				110					115					120			
Tyr	Glu	Thr	Phe	Asp	Val	Gln	Asn	Pro	Gly	Asp	Lys	Phe	Asn	Asn			
				125					130					135			
Asp	Ala	His	Lys	Tyr	Cys	Ala	Leu	Ser	Asn	Asp	Ser	Ser	Lys	Thr			
				140					145					150			

Met	Lys	Ser	Gly	Lys	Phe	Val	Phe	Leu	Lys	Asn	Glu	Gly	Leu	Ser
				155				160						165
Asp	Ile	Ser	Leu	Met	Leu	Asn	Val	Cys	Tyr	Asp	Ile	Ile	Asn	Lys
				170				175						180
Arg	Met	Pro	Phe	Ser	Pro	Tyr	Ile	Cys	Ala	Gly	Ile	Gly	Thr	Asp
				185				190						195
Leu	Ile	Phe	Met	Phe	Asp	Ala	Ile	Asn	His	Lys	Ala	Ala	Tyr	Gln
				200				205						210
Gly	Lys	Leu	Gly	Phe	Asn	Tyr	Pro	Ile	Ser	Pro	Glu	Ala	Asn	Ile
				215				220						225
Ser	Met	Gly	Val	His	Phe	His	Lys	Val	Thr	Asn	Asn	Glu	Phe	Arg
				230				235						240
Val	Pro	Val	Leu	Leu	Thr	Ala	Gly	Gly	Leu	Ala	Pro	Asp	Asn	Leu
				245				250						255
Phe	Ala	Ile	Val	Lys	Leu	Ser	Ile	Cys	His	Phe	Gly	Leu	Glu	Phe
				260				265						270
Gly	Tyr	Arg	Val	Ser	Phe									
				275										

<210> 45
 <211> 813
 <212> DNA
 <213> *Ehrlichia canis*

<220>
 <223> nucleic acid sequence of *E. canis* p28-9

<400> 45
 atgaattaca aaagatttgt tgtaggtggt acgctgagta catttgtttt 50
 tttcttatct gatggtgctt tttctgatgc aaatttttct gaagggagga 100
 gaggacttta tataggtagt cagtataaag ttggtattcc caatttttagt 150
 aatttttcag ctgaagaaac aattcctggt attacaaaaa agatttttgc 200
 gttaggtctt gataagtctg agataaatac tcacagcaat tttacacgat 250
 catatgaccc tacttatgca agcagttttg cagggttttag tggtatcatt 300
 ggatattatg ttaatgactt tagggtagaa tttgaagggt cttatgagaa 350

```

ttttgaacct gaaagacaat ggtaccctga gaatagccaa agctacaaat 400
tttttgcttt gtctcgaaat gctacaaata gtgataataa gtttatagta 450
ctagagaata acggcggttg tgacaagtct cttaatgtaa atgtttgtta 500
tgatattgct agtggttagta ttccttttagc accttatatg tgtgctggtg 550
ttggtgcaga ttatataaag ttttttaggta tatcattgcc taagttttct 600
tatcaagtta agtttggtgt caactaccct ctaaagtta atactatggt 650
gtttggtggg ggttattacc ataagggtgt aggtgatagg catgagagag 700
tagaaatagc ttaccatcct actgcattat ctgacgttcc tagaactact 750
tcagcttctg ctactttaaa tactgattat tttggttggg agattggatt 800
tagatttgcg cta 813

```

```

<210>      46
<211>      271
<212>      PRT
<213>      Ehrlichia canis

<220>
<223>      amino acid sequence of E. canis p28-9 protein

```

```

<400>      46
Met Asn Tyr Lys Arg Phe Val Val Gly Val Thr Leu Ser Thr Phe
          5              10              15
Val Phe Phe Leu Ser Asp Gly Ala Phe Ser Asp Ala Asn Phe Ser
          20              25              30
Glu Gly Arg Arg Gly Leu Tyr Ile Gly Ser Gln Tyr Lys Val Gly
          35              40              45
Ile Pro Asn Phe Ser Asn Phe Ser Ala Glu Glu Thr Ile Pro Gly
          50              55              60
Ile Thr Lys Lys Ile Phe Ala Leu Gly Leu Asp Lys Ser Glu Ile
          65              70              75
Asn Thr His Ser Asn Phe Thr Arg Ser Tyr Asp Pro Thr Tyr Ala
          80              85              90
Ser Ser Phe Ala Gly Phe Ser Gly Ile Ile Gly Tyr Tyr Val Asn
          95              100             105

```

